

Teaching Reading Is More Than a Science: It's Also an Art

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ABSTRACT

The role of the teacher, specifically teacher craft, is central to engaging students in effective reading instruction. However, the science of reading has revealed that the content taught is also important to reading acquisition. Although the science of reading was aggregated some two decades ago to result in what became known as the five big pillars, it has not been fully incorporated into instructional practice. Subsequent research has continued to inform and strengthen what we understand about reading, and new energy has now emerged to bring the science of reading fully into practice. However, the science of reading and teacher craft are each insufficient without the other. In this article, we discuss the art of teaching and advocate that it must be given serious consideration if the science of reading is to be adopted en masse by teachers. We also discuss several reading strategies and their role in effective reading instruction and the art of teaching.

It is the supreme art of the teacher to awaken joy in creative expression and knowledge. (Albert Einstein)

As Einstein's quote suggests, teachers can have tremendous influence on the academic and creative development of their students, to which we add their reading development. Literacy instruction is not only teaching the skills, strategies, and content of science-based teaching but also recognizing that teachers must be flexible and adaptive in their daily decision making and interaction with students to meet their literacy needs. Thus, the art of teaching involves professional judgments and adaptations to content delivery that teachers make to their reading instruction to ensure student success (Scales et al., 2018). We firmly stand on the science of reading (SOR) as it has established components that are critical to students' successful reading acquisition. Whereas Seidenberg, Cooper Borkenhagen, and Kearns (2020) argued that the SOR and teaching practice are two different entities, we maintain that the SOR has established the importance of the art of teaching reading. Further, we propose that the SOR and teacher craft are individually insufficient for effective reading instruction but, when properly blended, become powerful allies that lead to improved reading outcomes for all students.

The Art of Teaching

We define the art of teaching as being embodied in the teacher's decision making that involves selection, differentiation, and delivery of engaging

and efficacious reading instruction. Such decision-making processes occur daily and often on the fly within the social interactions of the classroom. Processes resulting in appropriately based reading instruction are founded upon teacher expectations for student learning that impact students' affect and attitude toward learning to read and reading itself (Connor et al., 2011; Heilman, Blair, & Rupley, 2002; Nichols, Jones, & Hancock, 2003; Nichols, Young, & Rickelman, 2007; Rupley, Blair, & Nichols, 2009; Watts-Taffe et al., 2012). We propose that the answer to "what is appropriate for these students in these circumstances" (Sanderson, 2003, p. 341) captures the breadth of teachers' judgments embedded within the art and craft of teaching literacy. Sanderson's statement implies that the teaching profession is not a technical occupation but one involving the relationship between a teacher and students that is dependent on the teacher's judgment (Rogers, 2019). Although we agree that teaching is not considered a technical pursuit, an effective reading teacher's judgment must reflect knowledge of the SOR and how best to use it with any given learner.

In *Reading Research Quarterly's* first special issue on the SOR, several authors addressed aspects of the art of teaching. Seidenberg et al. (2020) acknowledged that the complexities of the SOR causes it to be poorly translated into practice because teachers want to know what to do regarding instruction. In support of this problem, Solari et al. (2020) offered that the SOR would benefit from an effective model of translational science connecting research scientists to those involved in implementation. In their discussion of the pedagogical approach of adaptive teaching, Vaughn, Parsons, and Massey (2020) recommended that teachers should reach learners using knowledge of their cultural and linguistic strengths as opposed to an isolated, skills-based approach. We propose that these authors were describing an aspect of teacher craft. We also submit that when Hindman, Morrison, Connor, and Connor (2020) called for teaching instructional strategies to preservice teachers in addition to the SOR, Hindman et al. were recognizing the importance of the art of teaching. None of these authors specifically referred to the art of teaching in their work, but the notion is present and can be inferred in their concepts. In this article, we bring to the foreground the art of teaching and its importance to the SOR by naming it explicitly, reviewing research from the SOR that highlights its importance, and providing a classroom exemplar that demonstrates how blending the SOR of reading fluency with teaching craft can result in improved reading instruction.

We next review and discuss three lines of research established by the SOR that we submit as quantifying the components of teachers' judgment. In the first review, Seidel and Shavelson (2007) examined a framework measuring teacher effectiveness. In the second review, Connor et al. (2011) investigated the effect of student-tailored

literacy instruction. Third, we review the work of Pianta, la Paro, Payne, Cox, and Bradley (2002), as well as other authors, who adopted the perspective of teacher quality. All three research lines resulted in findings supporting the importance of teacher judgment that we maintain embodies the art of teaching.

Teacher Judgment

Teacher Effectiveness

A meta-analysis of teaching effectiveness by Seidel and Shavelson (2007) shed empirical light on the diverse variables that are part of teacher judgment and, hence, the art of teaching. In their analysis, the authors used a framework by Bolhuis (2003) that resulted in domains for knowledge (e.g., reading, math), time for learning (the amount of time students engage in learning activities), organization for learning (classroom management), and social context (the classroom social climate for learning). Seidel and Shavelson then analyzed these teaching variables across three components: learning processes (e.g., cognitive engagement, motivation, deep learning strategies), motivational/affective development (interest development, motivational orientation, beliefs, and attitudes), and cognitive attainment (knowledge measured by standardized or content tests, student performance, etc.). The authors found that the effect size (Cohen's d) outcomes for the time for learning component were 0.14 for learning processes, 0.12 for motivational-affective, 0.03 for cognitive, and 0.04 for a weighted aggregation of the components. For the differentiation component, effect sizes were 0.04 for motivational-affective, 0.03 for cognitive, and 0.04 for all outcomes. The structured teaching component resulted in effect sizes of 0.04 for learning processes, 0.07 for motivational-affective, 0.02 for cognitive, and 0.02 for all outcomes. The reinforcement component showed effect sizes of 0.05 for learning processes, 0.07 for motivational-affective, 0.01 for cognitive, and 0.02 for all outcomes. When domain-specific activities were analyzed for cognitive outcomes, effect sizes of 0.15, 0.18, and 0.30 were found for reading, mathematics, and science, respectively. In an examination of the elementary grades, the authors found that the largest effect sizes resulted from domain-specific learning activities ($d = 0.20$), time for learning ($d = 0.11$), organization of learning ($d = 0.08$), and social experiences ($d = 0.05$).

In sum, Seidel and Shavelson (2007) concluded that the effects of teaching, and hence of teacher craft, are complex and, when viewed in aggregate, important. We reason that the judgments teachers make when they plan, organize, and deliver instruction are critical to students' learning and reflective of teacher craft. As we discuss later, we advocate that great opportunity can be found in the combinatorial power of how such effects are informed

and assembled by teachers and that they are at the intersection of the SOR and teacher craft.

Given the measured effect of the art of teaching on the components of student learning, we advocate that it is vital that such research occurs from a variety of perspectives. Next, we discuss an investigation connecting readers' needs to the literacy instruction they receive from their teachers. Although the work is not framed within the art of teaching per se, we advance that it provides an empirical example of the effects of the art connecting teacher judgment to literacy instruction.

Literacy Instruction

Connor et al. (2011) investigated the relation between students' individual reading needs and the specific instruction necessary to meet those needs. The authors proposed that evidence-based instruction must consider the necessary instructional content, who is directing students' attention during the learning activity (teacher, student, or student/teacher managed), and the grouping configuration of students (whole class, small group, or individual). Each of these represents judgments that must be made by the teacher. As a result of their work, Connor and colleagues determined that the literacy needs specific to the students and the teacher's instruction delivered to meet those needs are causally related to students' reaction to instruction and that they exert a direct impact on students' reading achievement. Although they did not label such decision making as the art of teaching, Connor et al. found that key to advancing the reading achievement of each student was the teacher's ability to consider the reading needs of individual students, rather than viewing them as a homogeneous group. In other words, the teacher employs knowledge of the SOR in consideration of other known factors about the students to reach appropriate instructional judgments.

Consider, for example, judgments made by the teacher regarding assessment. A teacher has many choices regarding the assessment of students; different teachers will choose different approaches that reflect what they understand and believe about the SOR and the purpose and value of assessment to inform on the instructional needs of each student. There is, of course, an array of assessment choices that the teacher can select, which are a reflection of the individual's art of teaching. Although some may be uncomfortable with a particular teacher's art, it reflects the reality, independence, and variability generally afforded teachers that are inherent in their craft. Granted, some teachers will make better decisions for students than will others. The good news is that teachers can grow and evolve in their effectiveness through knowledge, support, and experience. In other words, teachers can and do improve their art of literacy instruction (Harris & Sass, 2008).

Teacher Quality

A third area of research found in the early childhood literature provides a quality-focused perspective of the art of teaching. We think this line of research partly captures teachers' art as reflected in the quality of their instructional judgments.

Pianta et al. (2002) used the term *quality* to refer to the teacher's use of instructional time, setting, activities, sensitivity on the part of the teacher to the interactions taking place with students, and the emotional climate present in the classroom. These various indicators were deemed to affect student development and are reflective of a teacher's craft. Along with other authors, Pianta et al. found that the quality of kindergarten classrooms has reliable and positive effects on the social and academic achievement of students (Alexander & Entwisle, 1988; Barnett, Young, & Schweinhart, 1998; Howes, Phillipsen, & Peisner-Feinberg, 2000; Mashburn et al., 2008; Ripple, Gilliam, Chanana, & Zigler, 1999). Although much of this research has been conducted in preschool, kindergarten, and first-grade settings, the attributes of quality are applicable to the art of teaching in later grades. In a longitudinal study by Vernon-Feagans et al. (2019), 1,292 students were followed from birth through grade 3. After controlling for poverty, home environment, and literacy skills at school entry, greater classroom quality was positively associated with third-grade literacy scores. This finding extends the results of Pianta et al. to grade 3 and lends further support for the particular characteristics of teacher craft, as interpreted within a perspective of quality.

As interpreted by Pianta et al. (2002), quality also included rating the numerous social interactions between teachers and students that occurred throughout the day. The importance of these interactions has been seen in the number of school-based interventions focused on effecting changes within the classroom-level processes that predict students' socioemotional and academic development (Brown, Jones, LaRusso, & Aber, 2010). Teachers play a critical role in the quality of teacher-student and student-student interactions; however, teachers can and do vary in the craft they bring to managing the social, emotional, instructional, and organizational interactions in the classroom (Brophy & Good, 1986; Cooley & Leinhardt, 1980). Quality in terms of instructional design, classroom environment, and teacher-student interactions has been shown to predict gains in students' academic, language, and social skills (Mashburn et al., 2008), whereas curricular materials and teacher qualifications have not (Cohen, Raudenbush, & Ball, 2003). This supports the idea that the implementation of quality is unique to the teacher and reflects the quality of the teaching craft. Brown et al. (2010) studied the effect of the socioemotional functioning of teachers and its effect on the quality of literacy instruction in third-grade classrooms. Positive

effects were reported for the teachers' perceived emotion on the quality of literacy instruction, with a moderate effect size of 0.52. The results from these authors suggest that classroom social interactions are impacted by the socioemotional intelligence of the teachers, again supporting that the art of teaching is important to students' literacy success.

We offer that these three lines of inquiry, although not explicitly addressing the art of teaching by name, provide empirical examples of its effect on student achievement. To recap, Seidel and Shavelson (2007) found significant effects on student learning in elementary grades for activities, learning time, organization, and the social experiences of students directed by teachers, which the authors surmised are complicated yet significant to student learning. Connor et al. (2011) looked specifically at literacy instruction and determined that a causal connection very likely existed between the content, attention, and grouping judgments made by teachers and the literacy achievement of students. Finally, using a framework of teacher quality, Pianta et al. (2002) and other investigators found that a variety of judgments made by teachers involving instructional time, setting, activities, and management of the emotional climate of the classroom are likely related to third-grade literacy achievement. It is of note that all three research lines have uncovered common areas where teaching craft, reflected in the judgments made by teachers across multiple areas, positively affected student achievement. This evidence from the SOR supports the idea that a teacher's craft has important effects on student learning and should be considered in conjunction with the SOR.

We now transition to an instructional example of the art of teaching using the science and pedagogy of reading fluency. In a recent article, Riley (2020) argued that although scientific insights should inform teaching practice, teachers must have space for choosing the necessary pedagogical decisions regarding instruction. Parsons, Dodman, and Burrowbridge (2013) noted that teachers utilize professional judgment to select various instructional strategies and techniques to address students' learning needs and that these instructional adaptations require teachers to be autonomous decision makers on behalf of their learners. Reading research is not contained to just the phonological processing and phonics domains; it informs all other domains as well. Reading fluency, which is reflected in the accurate pronunciation of words, the pace of reading, and the use of prosody (Kuhn & Stahl, 2003), is one such domain. In the next section, we discuss several examples of reading fluency instruction that have been supported by scientific studies meeting rigorous criteria. We present a brief overview of the scientific support and then discuss two strategies, repeated reading and Read Two Impress, with an eye toward the art of teaching.

Blending Science and Art in Reading Fluency Instruction

Putting the SOR into practice means teachers rely on their teaching craft to choose from among the many available instructional approaches that meet students' reading needs. Imagine a teacher planning for reading fluency instruction to improve reading rate, pronunciation, and prosody in students. The teacher has many scientifically supported options, such as repeated readings (Samuels, 1979), audio-assisted reading (Chomsky, 1978), paired reading (Topping, 1987), performance activities (Young & Nageldinger, 2014), choral reading (Rasinski, Reutzel, Chard, & Linan-Thompson, 2011), and reading interventions such as the neurological impress method (Heckelman, 1969). Thus, it is up to the teacher to decide what works best for the students based on how particular approaches can be modified to be more effective in the instructional context. Even when selecting a scientifically supported activity, the teacher often must make real-time modifications for individual students or classes. The ability and judgment necessary to adapt in meaningful and effective ways to contextual classroom and student circumstances without sacrificing the science is arguably an element of artful teaching. We now consider repeated reading as an umbrella strategy within which strategies such as Readers Theatre and Read Two Impress can be incorporated with a focus on prosody.

Repeated Reading

Our purpose in this section is to briefly describe the science behind reading fluency and its corresponding activities and to provide specific examples that illustrate the blending of science and art. As with other areas of reading development, building reading fluency in students requires both knowledge of the SOR and artful teaching skills. The National Reading Panel (National Institute of Child Health and Human Development, 2000) concluded that accurate word recognition and fluent reading must be present in readers to promote their reading development. One method of instruction that was noted was repeated readings. This method of instruction with meaningful feedback positively impacted students' reading achievement, most markedly up to grade 4 and with older learners who experienced difficulty in reading. Indeed, a large body of research supports the use of repeated readings (e.g., Lee & Yoon, 2017; Rasinski et al., 2011; Stevens, Walker, & Vaughn, 2017; Vadasy & Sanders, 2008). The method was most notably described by Samuels (1979), who found that repeated readings increased reading fluency and that the effects were transferable to new texts. In other words, repeatedly reading text was a form of practice that generalized to an increased ability to successfully read other, more challenging texts.

Repeated reading practice is effective because it promotes automaticity in reading (Kuhn & Stahl, 2003; Logan, 1988; Samuels, 1997). At first, it was theoretical; LaBerge and Samuels (1974) argued that as students become more automatic in word decoding, their cognitive resources were freed for other processes, such as reading comprehension (Perfetti, 1985). From a neurological perspective, automaticity occurs when words are stored for automatic recall in the occipital lobe. Rather than using decoding strategies, words are recognized effortlessly in connected text, allowing the temporal lobe to employ its semantic, meaning-making function (Carr, 1992; L. Cohen et al., 2002; Shaywitz et al., 2004).

In addition to the theoretical and neurobiological propositions, the science of reading fluency has direct implications for instructional applications. Knowing that one of the components of reading fluency is automaticity (Samuels, 2004), effective classroom fluency instruction could focus on practice through repeated readings. However, to bring authenticity and student engagement into classroom fluency instruction, considering the art of teaching becomes necessary (Nichols, Rupley, & Rasinski, 2008). Rereading the same text for the purpose of practice is not often used by adults in the real world for other than specific reasons. For example, people preparing to read for an audience, such as public speakers, actors, thespians, vocalists, and poets, practice a text repeatedly to successfully relate the meaning of the text through the use of pacing, correct word pronunciation, and effective prosody. Whereas *repeated reading* is the term associated with the science of reading fluency, a more artful term is *rehearsal* (Young & Nageldinger, 2014). An aspect of the art of teaching reflected in the delivery of these fluency strategies involves motivating students to engage in rehearsal, providing effective feedback encouraging students to continue reading, and helping students realize when they have improved their reading. We now discuss Readers Theatre and Read Two Impress as two examples of rehearsal strategies using repeated reading where teacher craft is evident.

Readers Theatre

When examining the science behind repeated readings, teachers can also consider real-world applications for authentic practice and then engage students using empirically supported instructional activities. In our first example, we use Readers Theatre as an artful and scientifically validated approach that teachers might choose, from a host of others, as a form of reading fluency instruction.

Readers Theatre evolved based on the science and art of teaching reading (Garrett & O'Connor, 2010; Young, Durham, Miller, Rasinski, & Lane, 2019). Groups of students select and rehearse a script, poem, or other text through repeated readings and ultimately perform the text

for an audience. The performance factor is an illustration of the art of teaching. Indeed, students could repeatedly read texts, but teachers can draw these texts from real life to provide authenticity in the classroom, which can influence motivation and active engagement (Millin & Rinehart, 1999; Wilfong, 2008). An important part of authentic performance is the use of prosody.

Teachers can instruct students to attend to prosody, another scientifically validated component of reading fluency (Benjamin & Schwanenflugel, 2010; Paige, Rasinski, Magpuri-Lavell, & Smith, 2014) and one often neglected in classroom settings (Dowhower, 1991). Prosody has been linked to reading comprehension (Goodman, 1964; Sabatini, Wang, & O'Reilly, 2019), and researchers have found that primary students who read with adultlike prosody are more likely to have improved reading comprehension in later grades (Daane, Campbell, Grigg, Goodman, & Oranje, 2005; Miller & Schwanenflugel, 2008). Daane et al. (2005) examined a subsample of fourth graders ($n = 1,779$) who took the National Assessment of Educational Progress. When analyzing the students' prosody (assessed by the oral reading fluency scale), they discovered that fourth graders who were rated as a 3 or 4 (on a 1–4 scale) were positively correlated with higher reading comprehension scores. Conversely, those fourth graders who scored on the lower end (1 and 2) were less likely to proficiently comprehend text. Similarly, Miller and Schwanenflugel (2008) conducted a longitudinal study following 92 students from first to third grade and reported that those who developed adultlike prosody in earlier grades demonstrated better comprehension by grade 3. Goodman (1964) noted this connection decades before, suggesting that students who read aloud with appropriate expression are actually demonstrating comprehension. Therefore, it makes sense to continue to artfully adapt scientifically validated research based on repeated readings through a strategy such as Readers Theatre that easily lends itself to prosody improvement.

Read Two Impress

Of course, adding performance is not the only option for teachers making decisions based on the needs of their students. Sometimes effective reading fluency instruction is less authentic but necessary if students do not respond to large group approaches. Our second example, of the many options for educators, describes a teacher who integrated her art of teaching with key decisions grounded in the SOR that resulted in an implementation called Read Two Impress (Young, Rasinski, & Mohr, 2016).

One third-grade student was not responding to the general reading curriculum and was nearly two years below grade level. After administering an informal reading inventory, the teacher found the student to struggle most with fluency and therefore decided to use the

method of repeated readings (Samuels, 1979). The teacher also thought carefully about text choice, what this third-grade boy might enjoy. Ultimately, the teacher chose to use humorous children's poetry. The teacher noted that the student enjoyed the texts even though he was required to read them four times, a small decision that minimized some of the monotony one might expect from repeatedly reading text. After several weeks, the teacher noticed that his accuracy and automaticity had improved, but his oral reading was still somewhat labored and monotone, indicating a need for increased attention to prosody.

After some research, the teacher decided to switch to the neurological impress method (Flood, Lapp, & Fisher, 2005; Heckelman, 1969) because research has shown that when a teacher models prosodic reading, it becomes etched or impressed into the student. That is, after participating in the neurological impress method, the student reads aloud with more adultlike expression, similar to the teacher or tutor. It was this aspect of the intervention that made the method seem like an appropriate choice for the third-grade student.

However, because the teacher had seen marked improvement with the use of repeated readings, the teacher was reluctant to remove this approach completely. Therefore, the teacher decided to modify the neurological impress method to include a repeated reading component. The teacher would engage the student in the method's type of reading for chunks of text (i.e., paragraph, page), and then the student reread the text aloud. After 18 weeks of the intervention, later named Read Two Impress (Young et al., 2016), the third-grade student was on grade level and reading with expression, and most importantly, he found great enjoyment in reading. Prior to the intervention, the student had no favorite books or authors and did not like to read. Fortunately, after becoming a more successful reader, he claimed Jeff Kinney as his favorite author.

These judgments made by the teacher were instrumental in the student's reading improvement. The teacher navigated the SOR and used her judgment inherent in her teaching craft, combined existing methods to create synergistic effects, which led to remarkable reading growth. We believe that this vignette helps illustrate how teaching is a blend of art and science.

After reading this vignette depicting fluency instruction, a reasonable question is this: How do teachers acquire the judgment that we contend is central to teaching craft? The assumption here is that teaching craft, and the judgment that informs it, is a source of variability across teachers. What then is the developmental process for acquiring and encouraging judgment in the art of teaching? Whereas much research has addressed how reading processes and pedagogy operate to result in efficient reading, outside of the research on literacy coaching, less research has explored the acquisition process

regarding judgment in teaching craft. This phenomenon has been called the transfer challenge, and in the next section, we turn our attention to its role in the integration of science and teaching art.

The Transfer Challenge

If the SOR is to be adopted at scale, it is important to understand how teachers acquire the decision-making ability to link the SOR to the art of teaching, what Kennedy (1999) called the problem of enactment. The ability to apply flexible thinking in the pursuit of problem resolution is critical to a teacher's success and is a feature of teaching craft. It has been noted that teacher education has turned its focus from defining the critical knowledge necessary for teaching to defining the knowledge and skills required for implementing specific teaching practices (Knight et al., 2015; McDonald, Kazemi, & Kavanagh, 2013). The motive for this change in focus is to help teachers learn to link knowledge to the action of daily teaching. Consequently, the transfer of knowledge is important to the development of clinical judgment and the art of teaching (Clarke, Truckenbrodt, Kriewaldt, Angelico, & Windsor, 2019; Horn & Campbell, 2015; McDonald et al., 2013). Clinical practice is a training method for novices that has been used in the medical field, particularly nursing, to help students connect knowledge to practice. Besides nursing, schools of education have also adopted the model for preparing preservice teachers (Carnegie Corporation of New York, 2001; Clarke et al., 2019). The development of teacher judgment, and hence teacher craft, begins in clinical practice where three core competencies are considered fundamental: a student-centered focus, evidence-informed practice, and the use of reasoning and judgment processes that can be explicitly articulated by the individual (Horn & Campbell, 2015; Kriewaldt, Davies, Rice, Rickards, & Acquaro, 2017).

Of importance is how novices, and we add experienced teachers, transfer the knowledge that informs the development of judgment and their ultimate art of teaching (D. L. Schwartz, Bransford, & Sears, 2005). Transfer of knowledge is normally perceived as new learning built on previous learning (National Research Council, 2000). However, Broudy (1977) suggested that knowing is more nuanced and consists of three kinds of knowledge. Replicative knowledge is command of the facts, applicative knowledge is the ability to apply existing knowledge to solve new problems, and interpretive knowledge reflects the meaning given by the individual to his or her existing schemata that serve as starting points for problem solving. Broudy asserted that although individuals may have difficulty in applying their knowledge, what is most lacking is interpretative knowledge. An impediment to

problem solving, and hence to development of teacher craft, involves how one observes and interprets a new problem, as this not only affects how it is initially framed but also directs subsequent thinking as to its possible solution (Bassok & Holyoak, 1989; Bransford & Stein, 1993; Chi, Feltovich, & Glaser, 1981; Gibson & Gibson, 1955; Greeno, Smith, & Moore, 1993; Marton & Booth, 1997; National Research Council, 2000; Schuyler, 2003).

D. L. Schwartz et al. (2005) pointed out that what gets transferred into the problem-solving context is limited by the individual's replicative and applicative knowledge. As much of teacher preparation is focused on recall, deep knowledge is too often left undeveloped. This makes it difficult for the individual to diverge from initial framing assumptions so adaptive expertise can develop (Hatano & Inagaki, 1986; Mylopoulos, Kulasegaram, & Woods, 2018; Wineburg, 2004). In other words, repeatedly approaching problems from an existing frame limits new learning. The development of adaptive expertise requires the individual to move beyond procedural knowledge to acquisition of conceptual knowledge (Mylopoulos et al., 2018). Broudy (1977) posited that analyzing the individual's interpretative thinking can lead to deeper understanding of how conceptual knowledge occurs and, ultimately, to positive teaching benefits.

Viewing teacher judgment in light of the transfer problem suggests at least two implications in the effort to merge the SOR with the art of teaching. First, in addition to procedural knowledge, core knowledge of the SOR must be explicitly integrated within clinical practice and professional learning to encourage development of conceptual knowledge. Second, experienced teachers are likely to have deep-rooted beliefs of reading development that may exclude or only partially include the SOR. This transfer-in knowledge results in repeated application of the same problem-framing paradigm that hinders new, adaptive thinking about solutions to reading instruction. Paying attention to what is being transferred in by the individual is important to helping him or her reframe thinking in an effort to develop the adaptive thinking and expertise necessary to reframe the reading problem and more successfully help all learners (Schoenfeld, 2020).

The SOR, the art of teaching, and the transfer problem are each important to the field of literacy. Some outside of literacy may think that the SOR has only recently evolved, and of course that is untrue. What is true is that the SOR has recently become the focus of much discussion and, hopefully, newfound acceptance. This has resulted in potentially new opportunities for those working to improve reading achievement at scale. We next address the difficult problem of at-scale implementation by identifying several challenges and then offer for consideration improvement and implementation science as two possible routes to change.

Moving Forward

Although we concur with Solari et al. (2020) that considerable obstructions exist to integrating the SOR with practice, the current momentum around the SOR offers a renewed opportunity. Various podcasts and news outlets have made the SOR a topic of discussion (Amplify, 2020; Hanford, 2018; S. Schwartz, 2020), and organizations such as Student Achievement Partners and The Reading League have been launched to specifically support research-based reading instruction. Despite these efforts, others have opted to continue business-as-usual instruction. Working to encourage the incorporation of the SOR into such a landscape has remained difficult. Many of us can attest to the fact that teachers often believe that they already practice effective reading instruction (T. Shanahan, personal communication, April 1, 2020). This means that made-up minds must be changed, and we concur with Riley (2020) that this requires a nuanced approach acknowledging the critical role of the teacher, the complexity of the science for those who are not familiar with it, and the patience and persistence necessary for instructional change to lead to encouraging results.

Goldberg and Alden (2020) commented that if the SOR is to be embraced by teachers, then teachers must be embraced by those espousing the science. In their article, the authors contrasted stances by those in the balanced literacy and SOR communities. Whereas Goldberg and Alden pointed out the teacher-friendly approach taken by balanced literacy, their summarization highlighted the pitfalls made by some in the SOR community (Lilienfeld, Ritschel, Lynn, Cautin, & Latzman, 2015). We advocate that researchers and practitioners must engage in work on an interactive basis; separately, they are each insufficient and yet indispensable to the successful implementation of instruction informed by the SOR. One source of difficulty is determining how to implement improvement strategies across multiple contexts, whereas more difficult yet is the installation of at-scale literacy instruction systems with a design focused on both the problem and the teacher (Park, Hironaka, Carver, & Nordstrum, 2013; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007). Agreement on the problem to be addressed, the necessary expertise needed to solve it, and how the various involved parties will work together to assist in the integration between research and practice is a critical start (Bryk, Gomez, & Grunow, 2011). We now introduce two related but distinct approaches—improvement science (traditionally called quality improvement) and implementation science—as offering considerable potential in pursuit of this work.

Improvement Science

Bryk (2015) proposed the science of quality improvement, also called improvement science, as a process for improving school outcomes. The history of improvement science,

a systemic method begun by Shewhart (1931) to improve manufacturing processes, has a long history of success and was applied to education on a limited basis in the 1990s (American Society for Quality, 2003). Bryk noted that in the age of solutionitis, school-based improvement initiatives focused on systemic methods for learning to improve have been undervalued and underused. This suggestion acknowledges that improvement, in this case literacy improvement, is more broadly based than a particular strategy or group of strategies. Working under the fundamental premise that a system left unchanged will continue to produce the same results, the discipline of improvement science uses evidence-based quantitative and qualitative methods to improve the effectiveness, efficiency, equity, timeliness, and/or safety of service delivery processes and systems (Deming, 2000; Lewis, 2015). Through root cause analysis, improvement science uses a wide variety of tools to uncover problems and variability, which can then be addressed in a plan-do-study-act cycle to improve the quality of a literacy instruction system. Whereas the plan-do-study-act process allows for rapid testing of possible solutions to a particular process, improvement of a large system requires persistence that can take two to four years, and establishing sustainability requires two to three years of implementation fidelity (Anderson & Fagerhaug, 2006; Fixsen, Naoom, Blase, Friedman, & Wallace, 2005; Lewis, 2015; Lyon, 2005).

Implementation Science

Implementation science studies how a practice that is evidence based becomes translated into a different context with effective implementation (Halle, Metz, & Martinez-Beck, 2013). In this regard, implementation science sits within the umbrella of improvement science. The scientific methods used by implementation science encourage the systematic and long-term adoption of evidence-based practice that improves the quality and effectiveness of practice (Eccles & Mittman, 2006; LeMahieu, Bryk, Grunow, & Gomez, 2017). Education often suffers following the exit of researchers and money as local building support dissipates, institutional memory of the intervention recedes, and business as usual gradually returns (Bauer, Damschroder, Hagedorn, Smith, & Kilbourne, 2015). Improvement and implementation science share similarities in that they both have a common goal of improving the quality of the system under investigation. However, implementation science addresses the important question of context, as what was successfully implemented in one setting may not transfer to another without significant adaptation (Correnti & Rowan, 2007). Through root cause analysis, improvement science identifies the subprocesses contributing to system variability and then identifies how they can be improved using a plan-do-study-act cycle. Rather than engage in root cause analysis

to identify problematic system variability, implementation science takes what is already known about successful system performance and encourages adoption of techniques already shown to be efficacious. It is implementation science that addresses these challenges by focusing on teachers and the instructional system within which they work.

We offer improvement and implementation science as potential methodologies for merging the SOR and the art of teaching. However, these methods are not part of the typical toolbox used by school administrators. These processes address fundamental processes rather than more easily remediated, cursory issues; therefore, they are not fast and do not lend themselves to the establishment of quick, short-term results. Improvement and implementation processes require long-term, continual, and focused attention and can yield permanent, productive change.

Conclusion

The SOR consists of a large body of knowledge describing the cognitive processes of reading and substantiates some of the instruction that bests facilitate its acquisition. Certainly, the teacher is the critical factor when attempting to improve reading outcomes (Rupley, 2011). The art of teaching acknowledges teachers' judgment and its role in the critical decisions made by teachers regarding the SOR and the selection, preparation, delivery, and assessment of literacy activities within the social interactions of the classroom. Of concern is how to merge the SOR with the art of teaching, for without the latter, the former may continue to be ignored to the detriment of a large percentage of students. To be clear, we believe that the science must become part of the art of teaching if positive reading outcomes are to change on a broad basis. In this article, we presented paths for moving forward that have been successful in organizations outside of education, particularly in the field of medicine that, like literacy, has a body of declarative knowledge that relies on the practitioner for effective implementation but that may also be largely influenced by contextual differences. If the SOR is to reach the promise demonstrated in the research, the field must successfully work to help practitioners learn to merge it with the art of teaching. Such learning will involve the examination of the processes reflected in teacher craft.

It is also our concern that the SOR not halt further development of instructional approaches by teachers. For example, Readers Theatre did not always have a research base; it was developed as an artful interpretation of the science. Although it is considered scientifically based now, it has not always been. We believe that teachers with a solid understanding of the SOR should absolutely modify, adapt, and innovate to move the field forward and improve student reading. An important part of implementation

science is learning to adapt the SOR to the local context. This requires a symbiotic relationship between teachers and researchers, the result of which can move reading achievement forward.

Finally, we emphasize that the current opportunity to introduce the SOR into instruction requires new tools and approaches. What has been done in the past has not succeeded in making at-scale changes to instruction that reflects the science; however, new processes offer encouragement. Although the use of improvement and implementation science processes has been limited in education, they have been highly successful in other sectors of society. Additionally, the Carnegie Foundation for the Advancement of Teaching has grouped participating schools into networked learning communities, where through the use of the tenets of improvement science, continuous improvement initiatives using the plan-do-study-act cycle developed by Shewhart (1931) are being implemented. Although it has been viewed by researchers through the lens of implementation fidelity, addressing the variance within the art of teaching allows for potential solutions to systemic problems to be scientifically addressed. Additionally, and significantly, recognizing teaching art has the benefit of bringing teachers into the research fold as integral partners of the implementation process.

Future Research

The issues we raised in this article concerning the art of teaching suggest several directions for future research. An often overlooked idea is the extent to which the conditions at a particular school are ready for significant change. The study of the receptivity of various school- and district-based stakeholders to improvement and change efforts can help inform reformers on whether the fundamental conditions are present that would suggest change might actually take root (Lyon et al., 2018). Understanding the mind-set of teachers and administrators and how they differ based on context, experience, and other factors can help inform the challenges and opportunities for change. Investigations into teachers' perceptions of their role in reading instruction, the amount and importance of the boundaries of their decision making, and how they view their involvement in fundamental change initiatives can help provide depth of knowledge to those initiating and driving change. Also of interest is the degree to which coherence exists in the meaning of literacy change between those introducing change and those being asked to engage in its adoption. Although many school-based personnel may nod in agreement that change is necessary and agree to be involved, this attitude may change after implementation has begun, as these same individuals may decide that they do not agree with the change, that it is too much work, or that it will not be successful. A common

complaint heard across school buildings and districts concerns the number of initiatives requiring administrator and teacher attention that reduces the capacity for more intensely addressing what is most important to student achievement.

Research into how such initiative overload effects and interacts with larger change projects is needed. Studies informing on the process, context, and culture of organizations and how these factors affect the adoption, assimilation, and ultimate routinization of an innovation would be very helpful in unraveling how the SOR and teacher craft interact. Research on leadership styles, culture and climate, attitudes toward risk-taking, and power balances can inform the extent to which innovation implementation can be successful. Also, research studying how networked improvement communities emerge and function in the transfer and sharing of information in the effort to improve is important (Bryk et al., 2011; Engelbart, 1992). Such studies could include how teachers absorb and apply the SOR in their teaching craft. Additionally, study of an organization's absorptive capacity as a learning organization to identify the factors that constrain or catapult learning would be helpful in preparing a school organization for change (Zahra & George, 2002). Finally, studies describing improvement and implementation science initiatives would help inform others on the intricacies of these processes.

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